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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Animal Industry

+ ANIMAL PROTEIN AND RELATED FACTORS IN ANIMAL NUTRITION

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At the World's Poultry Congress in Cleveland ten years ago, Dr. Mangold of Germany made a statement about animal proteins that summarized very well the viewpoint of that time. He said, "Therefore, to obtain a high standard of production in the poultry industry, we cannot afford to dispense with some protein of animal origin, because this is of greater biological value than all proteins of plants." This statement is repeated here to emphasize the change that has occurred. The research of the last ten years showed that the protein of soybean meal was very little, if at all, inferior in biological value to the protein of animal protein supplements. It revealed the presence of previously unknown dietary factors in animal protein supplements and identified one of these with the crystalline vitamin B₁₂. It showed that animal protein supplements could be replaced in some diets by soybean meal, calcium phosphate, and vitamin B₁₂; but that other diets of more restricted formula were made deficient in the still-unnamed factors if the above-mentioned replacement was made.

Such radical changes in viewpoint within a ten-year period have naturally led to some confusion. Probably the greatest present uncertainty concerns the relative practical importance of vitamin B₁₂ and the unnamed factors, and the relationships existing among them. The confusion is heightened by the lack of assay methods for the unnamed factors and by the well-recognized possibility that "vitamin B₁₂ potencies" determined by microbiological, chick, or rat assay are influenced by the unnamed factors. This confusion can only be resolved by learning more about the occurrence, and chemical and biological properties of these factors.

In the meantime the great need for vitamin B₁₂ in poultry feeds and the availability of new sources of the vitamin raise questions for which we must find immediate answers that are at least approximately correct. Perhaps the best way to discuss this subject is to list the four questions most frequently encountered and present the best available answers.

1. Is vitamin B₁₂ the Animal Protein Factor?

It is not the only Animal Protein Factor, but it is the most important one from a practical standpoint. Pure vitamin B₁₂, when injected into deficient chicks or added to a deficient diet, stimulates growth as effectively as does liver extract or a concentrate prepared from cow manure. Pure vitamin B₁₂ injected into incubating eggs of vitamin B₁₂ deficient hens improves hatchability of the eggs and viability, feathering, and growth rate of the chicks hatched. Pure vitamin B₁₂ does all these things if the deficient diet is made up of corn, soybean meal, alfalfa meal, butyl fermentation solubles, vitamin A and D oil, and mineral supplements. If the alfalfa meal and butyl fermentation

solubles are left out and riboflavin added, or if a purified diet is used instead of one composed of natural ingredients, then pure vitamin B₁₂ is beneficial but it doesn't do the whole job. There is evidence for the existence of at least two other unknown factors. According to work at Cornell, both of these factors are present in fish meal and in at least one sample of brewer's yeast. One is found in dried whey and to a certain extent in soybean meal; the other is found in liver paste. There is also evidence for the existence of unknown factors in alfalfa meal, distillers' solubles, and butyl fermentation solubles, which may or may not be identical with the factors mentioned above.

One may well ask for a justification of the statement made earlier that vitamin B₁₂ is the most important, from a practical standpoint, of the so-called "Animal Protein Factors." How can this statement be justified when so little is known of these factors? The justification lies in the fact that a severely restricted or purified diet must be used to produce a deficiency of the still-unknown factors, whereas, before the recent development of vitamin B₁₂ concentrates, a vitamin B₁₂ deficient diet could be made simply by omitting the fish and meat products from any practical feed.

This being true, it would seem logical to apply the name, Vitamin B₁₂ Supplements, to the new products rather than the presently used vague and misleading term, Animal Protein Factor Supplements. The name, Vitamin B₁₂ Supplement, would indicate the major value, perhaps the sole practical value, of these concentrates. The presence of other factors need not prevent the use of this term any more than the presence of pantothenic acid in butyl fermentation solubles prevents the use of the term, Riboflavin Supplement.

2. To what extent can animal protein supplements be replaced by the new fermentation products which contain vitamin B₁₂ and unknown factors?

Speaking conservatively, we may say that the animal protein supplements can be replaced in part, leaving a minimum of 4 percent of fish meal or 8 percent of meat meal in a high efficiency broiler mash, and 2 percent of fish meal or 4 percent of meat meal in a starting mash for chicks intended for flock replacement or in the total diet of breeders. If the feed already contains less than these amounts of animal protein supplements, and it is believed that many feeds do, there is a good chance that addition of a vitamin B₁₂ supplement will improve results. In numerous experiments all of the animal protein supplement has been replaced with good results, but in other experiments with other diets results have been inferior. It is necessary, therefore, to answer this question conservatively. When animal protein supplements are replaced, care must be taken to replace the protein, calcium, and phosphorus as well as the vitamins.

3. To what extent can reported vitamin B₁₂ potencies be used as a guide in making the substitutions discussed above?

Such reported potencies are the best guide available, but there is no certainty that the assay methods based on growth of microorganisms, chicks, or rats are completely specific. Ostensibly, since pure vitamin B₁₂ is used as a standard, these tests measure vitamin B₁₂ potency, but different organisms under different conditions may react differently to different forms of the vitamin or to the presence of the unknown factors. An assay with chicks is desirable in the case of supplements intended for use in poultry diets, but most of the available figures were determined microbiologically because of the greater speed of this method. It is believed that figures determined microbiologically represent at least a fair approximation of the vitamin B₁₂ potency for poultry, but in calculating levels of supplement on the basis of these figures, it would be well to allow a margin of safety. The following vitamin B₁₂ potencies of some of the best sources of this vitamin among feedstuffs were determined by a chick assay method and are expressed in micrograms per gram: fish meal 0.24, meat meal 0.08, fish solubles 0.75-0.98, crab meal 0.33.

4. In what classes of feeds is vitamin B₁₂ important?

Vitamin B₁₂ has been shown to be required for the growth of young pigs, chickens, and turkeys and to be required for reproduction in chickens. "Animal Protein Factor" has been reported to be required for reproduction in swine, and it seems likely that the observed effect was due to vitamin B₁₂. The need for a high concentration of this vitamin in the feed decreases during the growth period. In experiments at Beltsville pullets on range were not adversely affected if all vitamin B₁₂ supplements were removed from their diet when they were eight weeks old. Turkeys in slat-floored sun porches were adversely affected if vitamin B₁₂ supplements were totally removed when they were eight weeks old, but they were not harmed by a sharp reduction in vitamin B₁₂ content of the diet. The difference observed between the above-mentioned pullets and turkeys is believed to have been due, not to species, but to the difference between range and confinement. Vitamin B₁₂ supplements are not required in laying mashers unless the eggs are intended for hatching.

All of this may be summarized by saying that vitamin B₁₂ is important for growth and reproduction of swine and poultry and that the new vitamin B₁₂ supplements are recommended as partial replacements for animal protein supplements on the basis of a conservative evaluation of the stated potencies of the new products. The many unanswered questions may be looked upon as discouraging or challenging, depending upon the point of view. Finding the answers to these questions will require the efforts of State and Federal research laboratories, feed control officials, manufacturers of feed supplements, the formula feed industry, and the feeders. It seems safe to predict that the answers will not be long in coming.

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FEB 20 1950
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